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ABSTRACT

Though women constitute 53% of students graduating annually from provincially assisted Ontario universities with bachelors and first professional degrees, they tend to remain concentrated in fields more conventionally dominated by females, and their representation in traditionally male disciplines (engineering, applied science, mathematics, and physical sciences) is low. The percentage of men enrolling in the humanities, education, and social sciences has declined, so the imbalance is greater. Strategies for overcoming gender imbalances in universities are provided. Information is offered on recruitment and outreach (programs, promotional materials, and additional strategies); access (curricular initiatives, academic policies, financial aid and awards); climate; retention (support systems and ancillary services, counselling and advising, career development, role models, and visibility in the academic community); curriculum; data collection and research; and faculty and staff development. It is recommended that the Council of Ontario Universities recognize the relevance of this information to issues of teacher education and curriculum design and consider collective action by its member institutions to attract and retain women students in science and engineering. An appendix reports the percent of full-time female enrollment within field and level of study, and provides a list of 11 organizations of women in science and engineering. The paper contains 56 references. (SM)

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ATTRACTING AND RETAINING WOMEN STUDENTS FOR SCIENCE AND ENGINEERING

A Report from the Committee on the Status of Women in Ontario Universities

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HE 021 614

COUNCIL OF ONTARIO UNIVERSITIES

CONSEIL DES UNIVERSITÉS DE L'ONTARIO

ATTRACTING AND RETAINING WOMEN STUDENTS FOR SCIENCE AND ENGINEERING

A Report from the Committee on the Status of Women in Ontario Universities

Council of Ontario Universities
Conseil des Universities de l'Ontario
130 St. George Street, Suite 8039
Toronto, Ontario M5S 2T4

June 1988

This report was endorsed by the Council of Ontario Universities on May 25, 1988.

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INTRODUCTION

By 1985, while women constituted 53 percent of the students graduating annually from provincially assisted Ontario universities with bachelor's and first professional degrees, women students tended still to be concentrated in fields more conventionally dominated by females, and their representation in some traditionally male disciplines - notably engineering, applied science, mathematics and physical sciences - remained conspicuously low. Moreover, at the same time as more women have entered the humanities, education and social sciences, the percentage of men enrolled in these fields has declined (see appendix A). These gender imbalances in the major areas of study are important to the universities of Ontario, and indeed to the society as a whole, because they indicate that we may not be making the best use of the talents of the current and coming generations of our young people.

The problem of gender stereotyping of realms of scholarship and occupations is certainly not confined to the scientific and technological fields; rather it seems to be most acute there. Although the numbers of women entering science and engineering programmes have increased in recent years, their continuing underrepresentation remains a concern. Among the factors identified as contributing to this tendency (in addition to factors outside the direct control of the educational system such as parental influence and early feminine gender socialization) are withdrawal from or avoidance of mathematics; lack of female role-models; gender biases in classroom conduct, curricular materials and teacher expectations; and discriminatory practices within scientific institutions.

Sex stereotyping begins long before students enter university and elementary and secondary schools are undertaking or exploring a variety of initiatives to encourage students to consider the widest possible range of academic and employment options. To complement these efforts, universities have a vital role to play in mitigating possible gender biases in the programmes and services offered to students in *all* faculties, and especially in their high school liaison and other outreach efforts, career and other counselling services, instructional development projects, and teacher-training programmes.

In this report, the Committee on the Status of Women offers a number of strategies for overcoming gender imbalances in universities which Council might contemplate and direct to the appropriate personnel and units in their own institutions. To facilitate the referral process, the report is organized under the headings of recruitment and outreach, access, climate, retention, curriculum, data collection and research, and faculty and staff development. Many of the measures recommended here have the advantage of using systems which are already in place, making them relatively easy and inexpensive to coordinate and implement. Others, admittedly, are more ambitious undertakings, for which substantial commitments of monetary and personnel resources might be required.

A number of universities throughout the province have already put some of the following initiatives into effect. It is hoped that this report will provide an impetus for further developments.

In assembling this report the Committee on the Status of Women drew extensively from several sources, in particular, Julie Ehrhart and Bernice Sandler (1982), *Looking for More Than a Few Good Women in Traditionally Male Fields* and other relevant publications of the Association of American Colleges Project on the Status and Education of Women, Washington, D.C. These resources, among others, are cited in the accompanying bibliography.

RECRUITMENT AND OUTREACH

One of the most important means of increasing women's representation in non-traditional university studies is to display those fields as feasible, rewarding and receptive to women. A number of audiences are involved: students in the school system identifying their career options and making their course selections, high school graduates entering their first university year, adult women contemplating a return to formal education, and the various people who have influence over these individuals.

A wide range of pre-university experiences, special programmes and recruitment strategies can be implemented to promote women's interest and confidence in entering male-dominated disciplines. These include:

PROGRAMMES

- **Career days, workshops and conferences** for female students in junior high and high school. These programmes focus on creating career awareness, providing admission and other educational planning information and exposing participants to women employed in scientific and technological fields.

- **Residential math and science career programmes**, typically offered during the summer and of several days to several weeks duration. In addition to career workshops, programme content can include hands-on laboratory activity, participation in research projects, course work in scientific disciplines, visits to related employment settings and individual counselling.

- **The involvement of women students enrolled in science and engineering programmes as peer advocates** in high school visitations, career days, residential workshops, university student match programmes and other special outreach activities.

- **Regular high school visitation activities and on-campus information sessions** which incorporate discussion of the career decision-making process and information on opportunities for women in traditionally male fields. These should be offered to students in the early stages of their high school careers as well as to those in senior grades.

- **Academic "sampler" sessions** which provide those entering or returning to university with a preview of lectures, tutorials, laboratories, and/or problem-solving activities in a given subject area.

- **Career exploration courses** which can provide refresher skills and laboratory experience as well as instruction in career decision-making and information on various occupational opportunities in science and engineering.

- **Speakers' Bureau offerings** which include women faculty, staff and alumnae willing to speak to high school classes, parent and other community groups on the subject of women in science, engineering and technology.

- **Programmes directed at "influencers"** (parents, guidance counsellors and teachers) designed to increase awareness of the sex-stereotyping of math and science and the impact of math avoidance on career choice and to develop strategies for stimulating the interest and achievement of young women in these areas.

PROMOTIONAL MATERIALS

- **Special promotional materials** such as handbooks, brochures, fact sheets, posters, videos and slide shows for recruiting women into a specific college, faculty or programme of study. These materials, along with the academic syllabus, can feature interviews with women students, faculty and professionals in the field and contain information on relevant employment opportunities, print and people resources, and campus support services.

- **Regular recruitment literature and campus publications** which, through the use of gender-inclusive language and visual imagery, reflect the full spectrum of academic programmes available to women.

- **Kiosks in shopping centres and at educational fairs and conferences** featuring posters, videos, brochures and demonstrations aimed at attracting women to non-traditional studies.

ADDITIONAL STRATEGIES

- **Individual contact**, by phone or by mail, with those women students accepted for admission to science and engineering programmes to provide them with additional information and respond to inquiries.

- **Communications with advocacy groups**, community organizations and professional associations and networks committed to increasing women's vocational options, for example, organizations of women in science, engineering and technology, university women's clubs (see appendix B).

- **Spots on local television and radio** with women speaking on the topic of women in science and engineering.

- **Science talent search** on a local, regional or even national level designed to identify promising young people early and elicit their interest in university studies.

- **Recruitment of women scientists and engineers** from non-academic settings who are willing to participate in outreach initiatives.

ACCESS

Access is the ease with which students with the requisite interest and ability can undertake university studies. In the context of promoting the entry of women into science and engineering programmes, access entails the assurance that structures are in place to serve the needs of students who have the potential and desire to pursue studies in these fields but who may lack the required academic background, the elimination of institutional barriers that limit women's entry into non-traditional disciplines and the availability of financial aid. Universities share with schools the responsibility for narrowing gaps, where they exist, by developing upgrading or bridging courses, reviewing entry requirements, and instituting procedures to provide maximum flexibility while maintaining standards.

Access can be facilitated by a variety of means:

CURRICULAR INITIATIVES

- **Comprehensive transitional or bridging programmes** that offer the opportunity for those who lack the necessary subject prerequisites to acquire the academic foundation required for admission into math- and science-based programmes of study.

- **Re-entry programmes** directed toward women holding an undergraduate degree in a scientific field who are unemployed or underemployed, perhaps as a result of having taken a family-related career break. Such programmes can provide a mechanism to renew academic credentials in preparation for graduate studies, retrain for purposes of career conversion or re-entry into the technological workforce, or acquire the additional skills and knowledge necessary for career advancement.

  (The content and structure of bridging and re-entry programmes should be responsive to the needs and concerns of women. Ideally, they should combine

academic rigor with supportive and developmental ancillary services, for example, career counselling and information, child care, and training in study skills and time management. Care must be taken to ensure that course content include relevant women's scholarship and an analysis of the problems and issues that women in non-traditional areas are likely to encounter.)

- **Individual upgrading and remedial courses and high school equivalencies** (offered, for example, through centres for continuing education) to allow young people who wish to pursue math- or science-related courses or programmes to make up for earlier neglect or poor performance in prerequisite subjects.

- **Transfer opportunities** for those who wish to switch to math- and science-based majors. Special workshops and catch-up courses will be required.

ACADEMIC POLICIES

- **Admissions policies and standards** that are free of gender bias and that allow for reasonable discretion in admission requirements.

- **Flexibility and variety in programme structures and offerings** so that the full programme of courses in science and engineering can be available to part-time and summer students.

- **Distance education and telecourse opportunities** which offer a wide range of course selections to those wishing or needing to study off campus.

- **Class scheduling** which takes into consideration the needs and lifestyle of students with family responsibilities.

FINANCIAL AID AND AWARDS

- **Financial assistance and incentives** such as scholarships, bursaries and re-entry grants designated specifically for incoming and returning women students in science and engineering at the undergraduate, graduate and post-graduate levels.

- **Extensive publicity** (in, for example, a special directory) about the financial resources offered by both the university and outside sponsoring institutions; **active encouragement** of women to apply for the programmes for which they qualify.

- **Financial support for part-time students**.

- Fair and equitable distribution of **teaching and research assistantships and graduate fellowships**.

CLIMATE

The best efforts in recruitment and the most comprehensive and coordinated programme to facilitate access may well fail if attention is not paid to what has been termed a "chilly campus climate" for women. Sexist attitudes and behaviors which demean and devalue women or create an atmosphere of indifference persist at the university in blatant and subtle forms in the classroom, at orientation, in campus newspapers. If academic institutions are to be successful in their efforts to increase the participation of women in science and engineering, an active and coordinated effort must be made to eliminate these practices and ensure a hospitable and supportive learning environment for all students.

Measures that can be taken to improve climate include the following:

- An explicit, widely disseminated **policy statement** indicating that the university is committed to providing a positive and supportive climate for women students, faculty and staff.

- A strong **policy prohibiting sexual harassment** in all its forms.

- **Formal and informal procedures** for dealing with diverse complaints ranging from sexual harassment to other forms of invidious treatment of women based on gender.

- Climate questions as part of **course evaluations; special surveys** to assess classroom and general institutional climate.

- **Awareness programmes** to sensitize the campus community to climate issues and encourage the adoption of pedagogical practices which are consistent with the institution's equity objectives.

- **Gender-inclusive language and imagery** in all written and oral administrative and educational communications; **a style guide** for communicating gender parity.

- Consideration of the **special needs and concerns of women who are also members of other minority groups**.

RETENTION

To sustain the women enrolled in science and engineering programmes, it is essential for the university to ensure that the needs, interests and concerns of this population are effectively addressed. Resources and services are therefore needed to provide encouragement, practical support and developmental opportunities.

Many things can be done to promote retention, such as development of support systems and ancillary services, counselling and advising, career development, role models and increasing visibility in the academic community. Since many of these measures are interpersonal and advisory, they do not involve large new expenditures and could readily be incorporated into existing services provided by faculties, departments and student affairs offices.

SUPPORT SYSTEMS AND ANCILLARY SERVICES

- **Support groups, women's caucuses and networks, buddy systems and workshops** can provide encouragement and information as well as the opportunity to share experiences and discuss career and educational issues and goals.

- **Special orientation sessions** can be established for women entering male-dominated programmes (especially those in which there is a high attrition rate) to inform them about relevant support programmes, services and other campus resources.

- Academic supports such as **peer tutoring services, subject related clinics, computer training and study skills workshops** can assist those who, because of inadequate backgrounds, are experiencing difficulty in specific courses.

- Students with family or employment responsibilities need **child care arrangements** which are affordable and accessible in terms of hours of availability, **parent-locator services, parental and pregnancy leave, flexible office hours and flexible scheduling of academic tasks**.

COUNSELLING AND ADVISING

- **Testing instruments** used in vocational counselling must be free of gender bias in terms of their development, standardization, language and content. Women demonstrating interests and aptitudes in non-traditional disciplines and specialties should be encouraged to pursue such goals.

- **"At risk" students** (which may include those who lack adequate academic preparation, who are receiving marginal grades, or whose life circumstances are seriously impairing their academic performance) need the special attention of advisors in academic departments and counselling centres. Interaction between faculty and student counsellors could be used to identify and assist such students.

- **Advisors and mentors** can be drawn from faculty and senior and graduate students.

CAREER DEVELOPMENT

- **Educational and career planning workshops** can be developed especially for those considering pursuing employment in a traditionally male-dominated field. These should incorporate discussion of the career development issues women are likely to encounter and provide advice on how to maintain professional identity during career breaks.

- **Modules on career planning** and relevant occupational opportunities and role-model lectures on contemporary problems and issues in the field can constitute part of first year science courses.

- **Career resource centres** and other sources of occupational information should contain accurate, up-to-date materials on women in math, physical sciences, engineering, technology and other male-dominated fields.

- **Women alumnae** in science and engineering are often willing to talk with undergraduates about their experiences and the various opportunities available in their field. The university should establish a **network** of such women.

- Non-traditional students are likely to face unique pressures and challenges in a predominantly male working environment. They can be assisted by **professional skills development workshops** on topics such as job search strategies, leadership training, conflict management, negotiation skills, self-assertion, balancing career and family commitments.

- **Information on the professional associations and networks**, advocacy groups and campus bodies committed to promoting the development of women and women's issues in traditionally male-dominated fields should be made available to students. They should be encouraged to become actively involved in such organizations.

- **Programme-related summer and part-time employment**, particularly on-campus work and research experiences, can be immensely beneficial. The Ontario Work

Study Program, for instance, provides opportunities for on-campus work experience during the academic year.

- **Access to employment opportunities** can be facilitated by ensuring that women students are informed about cooperative programmes, internships, career fairs, on-campus recruitment activities and employers committed to employment equity.

- **Special information sessions** could be arranged to disseminate details concerning graduate school programmes, admissions and fellowships.

- **Postdoctoral fellowships for women in science** could be offered.

ROLE MODELS

- **Affirmative search and hiring procedures** (as outlined, for example, in the COU publication, *Employment Equity for Women: A University Handbook*) should be instituted to increase the number of female faculty, particularly in traditionally male-dominated disciplines such as math, science and engineering.

- Concerted efforts should be made to **appoint women to highly visible administrative posts** such as deans and department chairs.

- **Women professionals and visiting women scholars** including alumnae could be invited to give lectures, present their research and/or meet informally with students to discuss relevant on-the-job and lifestyle issues.

- **"Professor in residence"** programmes could bring women scholars into departments where women faculty are non-existent or few in number.

- **Faculty exchanges** could aim specifically at bringing in women scholars.

- **Women entering teacher education programmes** can be encouraged to specialize in non-traditional areas. They can act as role models for young students in schools.

VISIBILITY IN THE ACADEMIC COMMUNITY

- **The concerns, experiences and achievements of women students, faculty and staff** in traditionally male areas should be recognized in campus media, academic departments and student groups.

- Women students should be actively encouraged to become involved in **research projects, teaching opportunities, decision-making and advisory bodies and student government.**

- It must be ensured that **the contributions of part-time students** are acknowledged and that they are afforded every opportunity to participate fully in academic life.

- **Newsletters** could be published for and about women in science and engineering.

- **Special recognition awards** for women in science and engineering could be created.

CURRICULUM

The body of knowledge taught and the processes through which that knowledge is transmitted are important determinants of women's educational experience and can play a significant role in their decision to pursue non-traditional studies. Universities, by their structure and often by the curriculum itself, portray a male monopoly of scholarly, scientific and cultural life. Although the number of women's studies programmes focusing on women as an academic subject and examining issues within a scholarly feminist framework has increased in recent years, traditional curricula have been slow to embrace scholarship on and by women, especially in disciplines which, historically, have been the domain of men. This exclusion circumscribes notions of objective truth and conveys the message that the activities and contributions of women are inconsequential and irrelevant. Moreover, women students can be demeaned and alienated when curricular materials and instructional methods make use of male-oriented terminology, images and illustrations and ignore the perspectives and experiences of women.

In order for women to become full participants in the intellectual life of the university, each institution should carefully examine the extent to which academic concerns of particular relevance to women are marginalized and viewed as less important. Steps should be taken to ensure that curricula reflect and respond to the realities of the latest scholarship.

The following initiatives can be undertaken by academic departments to create a broader and more balanced curriculum. While many have universal application, they are particularly relevant to those disciplines in which women have traditionally been underrepresented:

- **Evaluation of curriculum designs and training processes** to ensure that they accommodate the diversity of experiences, problem-solving approaches and learning styles among students.

- **Development of procedures** to ensure that curriculum content and materials are free of gender bias and sex stereotyping.

- **Integration of scholarship by and about women** into all courses and disciplines.

- **Development of strategies to "humanize" science**: integration into science degree programmes of courses about the social and ethical issues involved in scientific research and about the history of women in science; incorporation of humanities courses in science programmes and vice versa.

- **Introduction of professional incentives** to encourage faculty members to undertake studies related to women in their field of specialization.

- **Inclusion of equity issues in the professional programmes of Faculties of Education**: provision of both pre-service and in-service units on classroom climate, non-sexist curriculum design, career stereotyping and the importance of increasing the participation of women in math and science, and strategies for promoting female students' interest and confidence in these areas.

- **Increased flexibility in the structure and organization of major and honours selection** so that first-year students have the opportunity to explore options before defining their study and career objectives.

DATA COLLECTION AND RESEARCH

Given their technical and human resources, universities are in an excellent position to generate data integral to their own educational equity objectives and to contribute to the the growing body of research on women's participation in traditionally male-dominated careers. Quantitative and qualitative data can be collected and analyzed for purposes of determining relevant demographics and trends, discovering and documenting inequities, ascertaining needs, developing action strategies, and measuring progress.

Types of quantitative data that should be tabulated by field of study, degree level and gender and reviewed on a regular basis include:

- application and enrolment figures,
- attrition and graduation rates,
- student grades,

- the award of scholarships, bursaries and other financial incentives,

Possible research projects of a more qualitative nature include:

- Investigating why women students at the undergraduate and graduate levels **drop out of science and engineering programmes and courses**.
- Studying why certain women students who were accepted for admission into non-traditional programmes of study **did not, in fact, enroll in them**.
- Surveying senior students and alumnae in science and engineering fields to investigate their **educational and career development experiences**.
- Tracking and recording by academic departments and alumnae offices of the **career progression of women graduates from science and engineering programmes**.
- Developing methods to identify **"at risk" students** and strategies for keeping them in their programme.
- Encouraging research on the **history of Canadian women in science** and their contribution to scientific knowledge and research.
- Supporting the efforts of **university personnel conducting studies** in the area of women's vocational aspirations and interest and literacy in math and science.
- Devising mechanisms to **evaluate the short- and long-term results of programmes** implemented to achieve the objectives described in this report.

FACULTY AND STAFF DEVELOPMENT

Since many of the measures proposed above centre on university faculty and administrative staff, it is important that these individuals be aware of the ways in which the academic, administrative and interpersonal climate can affect the achievement and motivation of women students in the sciences and engineering.

Among the many possible initiatives to increase such awareness the following are offered as suggestions:

- **Inclusion of climate issues** and information concerning the university's commitment to educational equity in **orientation and development programmes** for faculty, teaching assistants and staff.

- Promotion of awareness of women's career development and participation in science and engineering through activities such as a **community symposium, special lecture series or faculty club exhibit**.

- **Provision of training** for admissions, liaison, counselling, community relations and other personnel involved in the recruitment process to assist them in their efforts to attract women into male-dominated programmes of study.

- Development of an "**ethics of equity**" brochure or workshop for graduate supervisors.

- Insisting on the example of **equitable treatment of all university personnel**.

CONCLUSION AND RECOMMENDATIONS

The contribution of scientific and technical education and research to future economic growth is recognized by the universities, the provincial and federal governments and the business community. So too is the link between equity and economic development. Indeed, an integral component of expanded scientific activity is the availability of highly-qualified personnel; in this regard Ontario has barely begun to tap the human resource potential of one-half of its population.

This report has provided illustrations of the various initiatives and programmes that could help to address the issue of the low participation of women in many scientific and technical disciplines. Although some of these measures require investment of resources in the short term, society and educational institutions themselves, as well as individual women, will benefit from having more women completing degrees in these key fields.

By giving serious consideration to the enrolment and retention of young women at all levels, the universities will also be acting in their own best interest by enlarging the pool of female faculty candidates in fields where serious personnel shortages are anticipated in the near future. Both the research and educational missions of the universities will be strengthened by the increased participation of women.

Given therefore the interest of the universities of Ontario in improving the

Given therefore the interest of the universities of Ontario in improving the status of women, in promoting equity in the workplace and in participating in the technological expansion of the Ontario economy, and given the responsibility of the universities of Ontario to train highly qualified personnel for all of the foregoing as well as for the universities' own staffing needs, the Status of Women Committee urges the adoption by COU of the following recommendations:

1. that the Council of Ontario Universities adopt the report *Attracting and Retaining Women Students for Science and Engineering* and urge its consideration by member institutions and COU affiliated organizations;

2. that the Council of Ontario Universities place the matters raised in the report *Attracting and Retaining Women for Science and Engineering* on the agenda of its two task forces studying "universities into the 21st century";

3. that the Council of Ontario Universities consider collective action by its member institutions in order to promote the attraction, admission and retention of women students for science and engineering;

4. that the Council of Ontario Universities recognize the relevance of this report to issues of teacher education and curriculum design and therefore bring the report to the attention of their Faculties of Education, of the Ministry of Education and its Teacher Education Review Committee.

5. that the Council of Ontario Universities bring the importance of the matters raised in the report *Attracting and Retaining Women Students for Science and Engineering* to the attention of the Premier's Council.

The Committee on the Status of Women looks forward to Council's endorsation of this report and suggests that the Executive Heads use their good offices to promote initiatives that involve other educational sectors, such as liaison with the high schools and with the Ministry of Education. In taking a leadership role is this area, the universities will show themselves to be responsive to their students and to the larger community. The Committee on the Status of Women would be pleased to assist individual institutions to develop programmes and to help Council in monitoring progress.

APPENDIX A

PERCENT FULL-TIME FEMALE ENROLMENT WITHIN FIELD AND LEVEL OF STUDY

	Fall 1975			Fall 1985		
	UG*	M	D	UG	M	D
Arts & Science	48.4	-	-	53.8	-	-
Education	55.5	50.4	42.8	61.2	63.5	60.4
Fine & Applied Arts	61.2	62.7	40.4	60.7	60.1	51.7
Humanities & Related	55.9	41.3	35.7	62.6	54.9	45.2
Social Sci. & Related	38.6	28.9	28.4	51.6	45.3	45.8
Agric. & Biol. Sciences	50.6	32.3	24.0	56.4	44.8	29.7
Eng. & Appl. Sciences	5.9	4.3	5.6	12.3	12.5	7.6
Health Prof.& Occupations	56.9	50.8	24.2	56.3	68.2	39.7
Math & Phys. Sciences	27.1	14.6	9.6	29.1	22.1	16.6
Not Reported	46.7	31.3	14.3	50.0	48.8	0.0
TOTAL	42.6	29.9	24.8	49.0	43.9	35.5

*UG: Undergraduate, M: Master's, D: Doctorate

Source: Ministry of Colleges and Universities, *Status of Women in Provincially Assisted Ontario Universities and Related Institutions, 1975-76 to 1985-86.* Toronto, July 1987.

APPENDIX B

GROUPS AND ASSOCIATIONS OF WOMEN IN SCIENCE AND ENGINEERING

Association of Professional Engineers of Ontario,
Women's List
1155 Yonge Street
Suite 101
Toronto, Ontario
M4T 2Y5

Canadian Association for Women in Science (CAWIS)
P.O. Box 6054, Station "A"
Toronto, Ontario
M5W 1P5

Canadian Association of Physicists,
Women in Physics Committee
151 Slater Street
Suite 805
Ottawa, Ontario
K1P 5H3

Canadian Biochemical Society, Opportunities for
Women Committee
Contact: Dr. Joan Boggs
Dept. of Biochemistry
Hospital for Sick Children
Toronto, Ontario
M5G 1X8

Federation of Medical Women of Canada
1815 Alta Vista Drive
Suite 201 A
Ottawa, Ontario
K1G 3Y6

International Organization (of Mathematics and Statistics),
Women's Caucus
Contact: Shirley Mills
Mathematics Dept.
Carletion, University

International Organization of Women and Mathematics
Education (IOWME)
Contact: Professor Gila Hanna
Dept. of Measurement, Evaluation
and Computer Applications
Ontario Institute for Studies in
Education

Ontario Association of Certified Engineering
Technicians and Technologists (OACETT),
Committee on Women's Issues
40 Orchard View Blvd.
Suite 253
Toronto, Ontario
M4R 2G1

Society for Canadian Women in Science and
Technology (SCWIST)
P.O. Box 2184
Vancouver, B.C.
V6B 3V7

Women in Information Processing (WIP)
Contact: Germain Gaudet
133 Torresdale Ave.
Suite 2105
Willowdale, Ontario
M2R 3T2

Women in Science and Engineering (WISE)
National Address: Box 6067, Station "A"
Toronto, Ontario
M5W 1P5
Also local chapters

BIBLIOGRAPHY

Ainley, Marianne Gosztonyi. "Women Scientists in Canada: The Need for Documentation", *Resources for Feminist Research/Documentation sur la Recherche Feministe*, vol. 15, no. 3, 1986.

Anisef, Paul. *The Pursuit of Equality: Evaluating and Monitoring Accessibility to Post-Secondary Education in Ontario*. Toronto: Ontario Ministry of Education, 1982.

Association of American Colleges, Project on the Status and Education of Women. "Non-Traditional Careers". Reprinted from *On Campus With Women*. Washington, D.C., Spring, 1981.

Association of American Colleges, Project on the Status and Education of Women. *Recruiting Women for Traditionally "Male" Careers*. Washington, D.C., 1977.

Benston, Margaret. "Feminism and the Critique of Scientific Method" in Finn and Miles (eds.) *Feminism in Canada: From Pressure to Politics*, Montreal: Black Rose Books, 1982.

Bogart, Karen. *Toward Equity: An Action Manual for Women in Academe*. Washington, D.C.: Association of American Colleges, Project on the Status and Education of Women, 1984.

Ching, H.L. *Proceedings of First National Conference on Women in Science, Engineering and Technology*. Vancouver: SCWIST, 1983.

Cohen, Leah. *Review of Women's Participation in the Non-Traditional Occupations*. Technical study, no. 8. Ottawa; Canadian Task Force on Labour Market Development, 1981.

Coniglio, Connie. *Women in the Professions*. Research project sponsored by Counselling and Career Development Services, University of Western Ontario and Employment and Immigration Canada, 1987.

Council of Ministries of Education. *Women's Issues in Education in Canada*, 1987.

Decore, Anne Marie. "Vive la Difference: A Comparison of Male-Female Academic Performance", *The Canadian Journal of Higher Education*, vol. 14, no. 3, 1984.

Department of Freshman Engineering. *Putting It All Together: A Model Program for Women in Engineering*. West Layfayette, Indiana: Purdue University, 1982.

Ehrhart, Julie and Bernice Sandler. *Looking for More Than a Few Good Women in Traditionally Male Fields*. Washington, D.C.: Association of American Colleges, Project on the Status and Education of Women, 1982.

Fee, Elizabeth. "Is Feminism a Threat to Scientific Objectivity?", *International Journal of Women's Studies*, vol. 4, no. 4, 1981.

Franklin, Ursula. *Will Women Change Technology or Will Technology Change Women?* Ottawa: Canadian Research Institute for the Advancement of Women, March, 1985.

Franklin, Ursula. "The Second Scientist", *Canadian Forum*, December, 1985.

Glaze, Avis and Donna Ellis. "Ontario Girls' Career Aspirations and Expectations", *Orbit*, vol. 3., June, 1980.

Haas, Violet and Carolyn Perucci (eds.). *Women in Scientific and Engineering Professions*. Ann Arbor, Michigan: University of Michigan Press, 1984.

Hacker, Sally L. "The Culture of Engineering: Woman, Workplace and Machine", *Women's Studies International Quarterly*, no. 4, 1981.

Hacker, Sally L. "Mathematization of Engineering: Limits on Women", in Joan Rothschild (ed.), *Machina ex Dea*. New York: Pergamon Press, 1983.

Hall Roberta and Bernice Sandler. *Academic Mentoring for Women Students: A New Look at an Old Way to Get Ahead*. Washington, D.C.: Association of American Colleges, Project on the Status and Education of Women, 1983.

Hall, Roberta and Bernice Sandler. *The Classroom Climate: A Chilly One for Women*. Washington, D.C.: Association of American Colleges, Project on the Status and Education of Women, 1982.

Hall, Roberta and Bernice Sandler. *Out of the Classroom: A Chilly Campus Climate for Women*. Washington, D.C.: Association of American Colleges, Project on the Status and Education of Women, 1984.

Harding, Sandra. *The Science Question in Feminism*. Ithaca: Cornell University Press, 1986.

Humphries, Sheila (ed.). *Women and Minorities in Science: Strategies for Increasing Participaton*. Boulder, Colorado: Westview Press Inc., 1982.

Kaseberg, A. *et al. Use Equals to Promote the Participation of Women in Mathematics*. Berkley, California: Math/Science Network, Lawrence Hall of Science, University of California, 1983.

Keller, Evelyn Fox. *Reflections on Gender and Science*. New Haven and London: Yale University Press, 1985.

Kenshaft, P.C. "Women in Mathematics", *Signs*, vol. 7, 1982.

Koltnow, Joanne. *Expanding Your Horizons in Science and Mathematics: Conferences for Young Women Interested in New Career Options*. Newton, Mass.: Women's Educational Equity Act Program, 1980.

Labour Canada. *When I Grow Up...Career Expectations and Aspirations of Canadian Schoolchildren*. Ottawa, Ontario,1986.

Messing, Karen. "What Would a Feminist Approach to Science Be?" in *Resources for Feminist Research/Documentation sur la Recherche Feministe*, vol. 15, no. 3., 1986.

National Science Foundation. *Women: Their Under-Representation and Career Differentials in Science and Engineering*. (Proceedings of a Conference). Washington, D.C., 1986.

Nelson, Fiona. "Sex Stereotyping in Canadian Schools" in Gwen Matheson, ed. *Women in the Canadian Mosaic*. Toronto: Peter Martin, 1976.

Ontario Ministry of Colleges and Universities: University Relations Branch and Statistical Information Services. *Status of Women in Provincially Assisted Universities and Related Institutions 1975/76 to 1985/86*. Toronto, 1987.

Orpwood, G.W.F., I. Alan and J.P. Souge. *Science Education in Canadian Schools, vol 11*. Statistical Database for Science Education. Hull, Quebec: Canadian Government Publishing Centre, 1984.

Reich, Carol and Helen La Fontaine. "The Effects of Sex on Careers Within Education: Implications for a Plan of Action", in *Canadian Journal of Education*, vol. 7, no.2, 1982.

Rogers, Pat. *Real Women Don't Do Math...Or Do They?* Department of Mathematics, York Univeristy. (Ten-minute video sponsored by the Public Awareness Program, Government of Canada.)

Romm, Toilia. "Interaction of Vocational and Family Factors in the Career Planning of Teenage Girls - A New Developmental Approach", *Interchange*, vol. 11, no. 1, 1980/81.

Rossiter, Margaret W. *Women Scientists in America: Struggles and Strategies to 1940*. Baltimore: John Hopkins, 1982.

Sayer, Liz and Audrey Swail. *Sex Bias in Vocational Testing*. Ontario Women's Directorate, 1983.

Schiff, Daphne. *Women in Science*. Faculty of Science, York University. (video)

Science Council of Canada: Science and Education Committee. *The Science Education of Women in Canada: A Statement of Concern*. Ottawa: Ministry of Supply and Services, 1982.

Science Council of Canada. *Who Turns the Wheel: Proceedings of a Workshop on the Science Education of Women in Canada*. 1982.

Scott, Joan Pinner. "Science Subject Choice and Achievement of Females in Canadian High Schools", *International Journal of Women's Studies*, vol. 4, September-October, 1981.

Secor Inc. *Women Engineers: Their Careers, Their Workplace*. Ottawa: Canadian Council of Professional Engineers, 1983.

Shaffer, Beverly (director). *I Want to Be an Engineer*. National Film Board, Studio D.

Sheinin, Rose. "The Rearing of Women for Science, Engineering and Technology", *International Journal of Women's Studies*, vol. 4, no. 4, 1981.

Simeone, Angela. *Academic Women: Working Towards Equality*. Boston: Bergin and Garvey Publishers Inc., 1987.

Smith, C. *et al. Broadening Career Options for Women*. Ann Arbor, Michigan: ERIC Counseling and Personnel Services Clearinghouse, University of Michigan, 1982.

Statistics Canada. "Women Entering Bachelor's Degrees; Changing Directions", *Education Statistics Bulletin/Des Statistiques de l'education*, vol.9., no. 5, 1987.

Stephenson, Marylee. "Sexism in Popular Science Books", *Signs*, vol. 4, no. 1, 1979.

Strong-Boag, U. "Canadian Women Doctors: Feminism Constrained" in S.E.D. Shortt ed., *Medicine in Canadian Society*. Montreal: McGill Queen's Press, 1981.

Stuckey, Johanna (general ed.). *Canadian Woman Studies/les cahiers de la femme: Science and Technology*. vol 5., no. 4, Summer, 1984.

Whyte, Karen. *Women and Science: A Contradiction in Terms?* Discussion paper prepared for the COU Committee on the Status of Women. Toronto, 1987.

Wiggan, L. "Mathematics: the Invisible Filter - a Report on Math Avoidance, Math Anxiety and Career Choices". Mathematics Department, Toronto Board of Education, 1982.

Wong, Paul T., P. Kettlewell and C.F. Sproule. "On the Importance of Being Masculine: Sex Role, Attribution and Women's Career Achievement", *Sex Roles*, vol. 12, 1985.